Space Weather Technical Forecast

Issued on Saturday, 02 July 2022 at 01:14 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Active electron fluence continuing. Slight chance of M-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Very Low over the past 24 hours, with no significant flares. There are currently 5 sunspots regions on the visible disc. AR3040 (Dao/Beta) to the southwest is the largest region, but is also relatively stable. A newly numbered region, AR3046, in the northeast has been classified as a Hsx/Alpha, which will continue to be monitored for any further development, although it appears to be benign. The three remaining regions appear to be small and stable. No Earth-directed CMEs were observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind speed has been around 330km/s through much of the past 24 hours, but increased from 330km/s to 350km/s from 01/0900UTC. Density also increased from 3ppcc to a peak of 24ppcc at 01/2100UTC. This appears to represent the arrival of a weak CME. This assumption is supported by a slight increase in the weak magnetic field and a change in the Bz component from weakly positive to weakly negative, with -10nT at 01/2135UTC. Phi angle has been negative (towards the Sun) throughout. Resultant geomagnetic activity was Quiet (Kp1-2), with isolated Unsettled and Active (Kp 3-4) intervals between 01/1800-0000UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) as measured by GOES16 remained at background levels throughout the period. The high energy electron flux (greater than 2MeV) remained high throughout, with a peak of 6970 pfu at 01/1720UTC. Electron fluence was above the Active (1e8 integrated pfu) threshold with a steady trend. An observed fluence of 2.62e8 integrated pfu was recorded at 02/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be Low or Very Low, with a very slight chance of Moderate activity.

Solar Wind / Geomagnetic Activity: A slow CME arrived at the Earth on 01 July. Assuming that this was not a forecast feature, further weak CMEs may also arrive at Earth on Day 1 (02 July) and Day 3 (04 July). Solar winds are otherwise expected to remain at ambient levels throughout the period, although solar winds may increase to slightly elevated late on day 4, with possibly the arrival of a high speed stream from CH97. Geomagnetic activity is forecast to be mainly Quiet, with isolated Unsettled intervals.

Energetic Particles / Solar Radiation: In the absence of any significant sunspot development, the high energy proton flux (greater than 10 MeV) is expected to remain at background levels. The high energy electron flux (greater than 2MeV) is expected to be mainly above the high (1e3pfu) threshold, but with a decline in the diurnal peaks. Electron fluence values are expected to remain above the Active (1e8 integrated pfu) threshold on 02 July, but with a gradual decline

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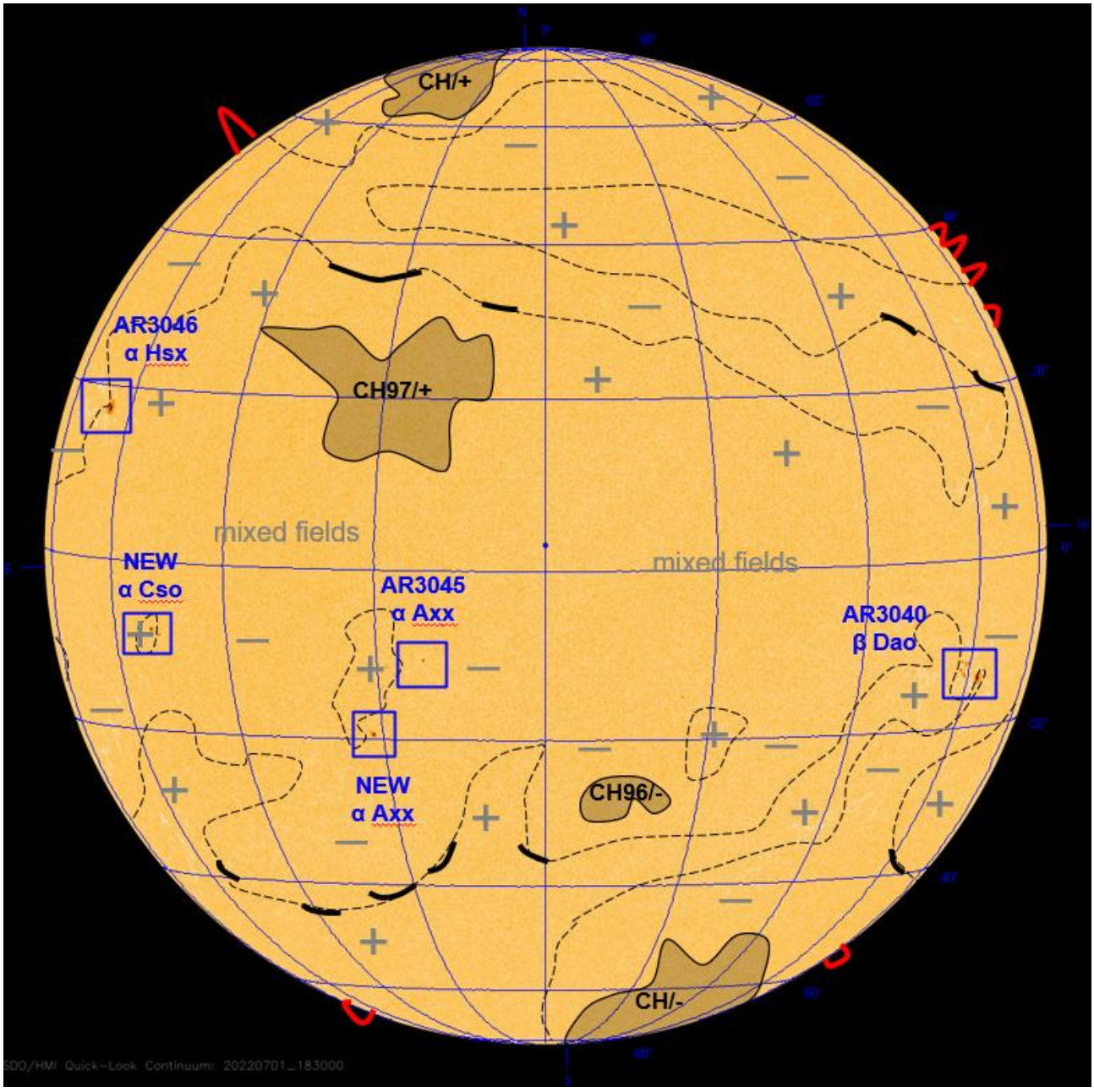
through the next four days, more especially with the potential arrival of HSS from CH97 by day 4 (05 July).

Figure 1. Solar Analysis Valid 01/1830UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

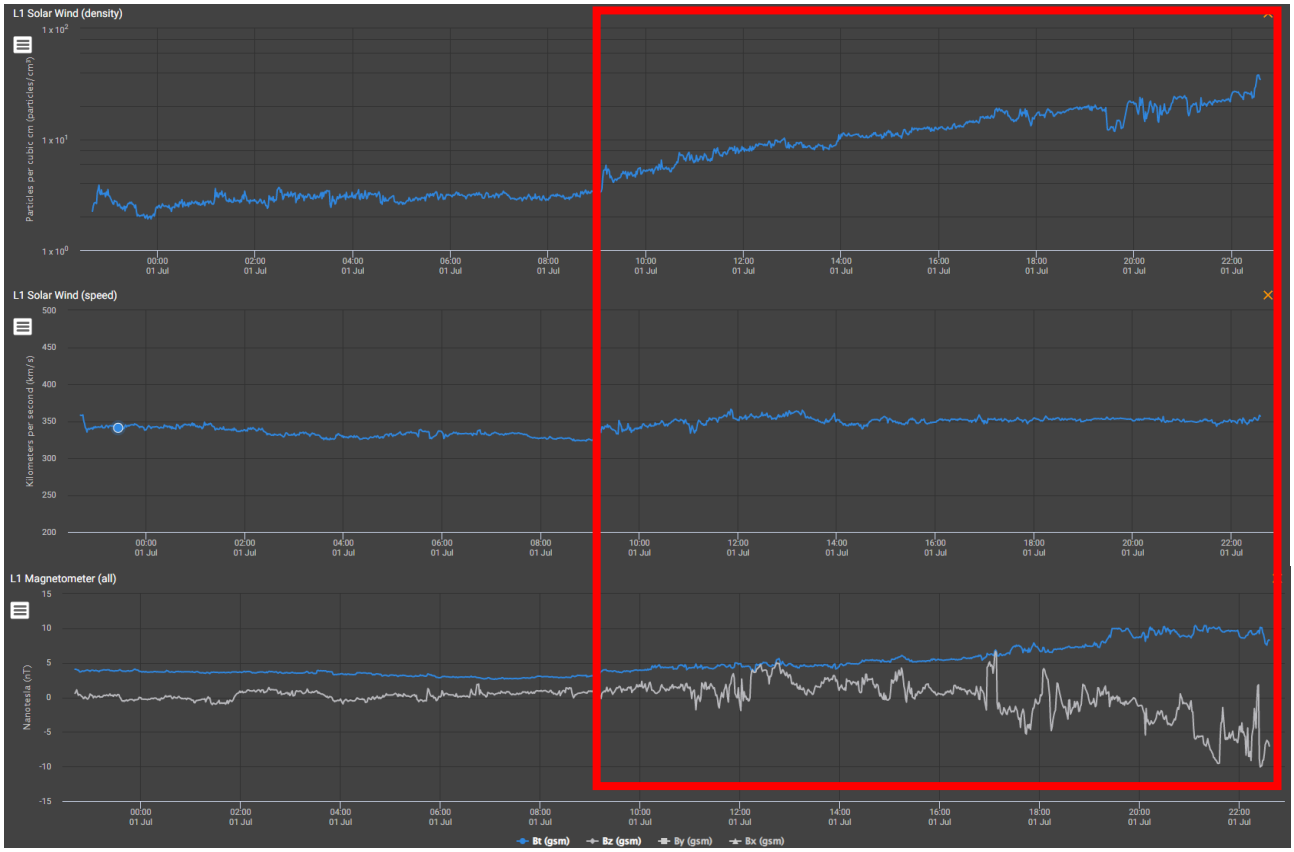
A CME appears to have arrived on 01 July, although it is uncertain as to whether this is the same feature forecast to arrive on 02 July. A further CME may also arrive late on 04 July into the 05 July. All these features have been observed to be, or are forecast to be, slow and weak, with no significant increase in solar wind speed or geomagnetic activity.

Otherwise solar wind speeds are expected to remain relatively muted, until at least day 4 (05 July) with the possible arrival of a high speed stream from CH97/+.

Geomagnetic activity is forecast to be mainly Quiet, with isolated Unsettled intervals.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: L1 solar wind observations – shows a weak transient (CME) in the wind flow (red box).



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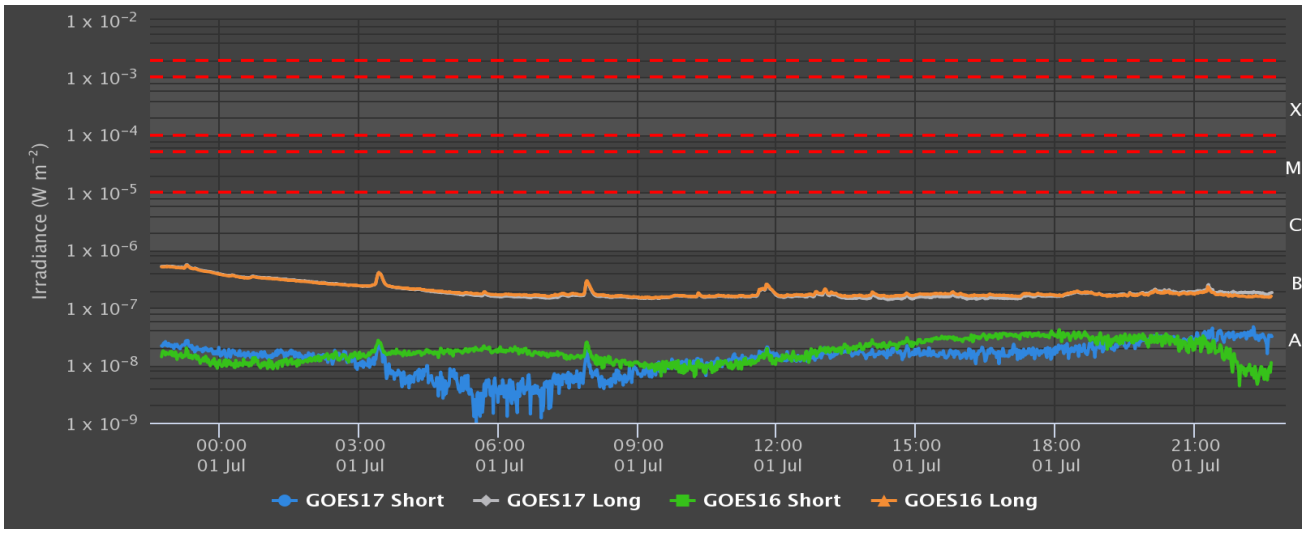
Radio Blackouts - X-Ray Flares:
Solar activity has been Very Low, with no significant or active sunspots on the visible disc. The largest region in the southwest AR3040 (Dao/Beta) is the largest and most mature, but is also apparently stable. A newly numbered sunspot region AR3046 in the northeast has a simple Hsx/Alpha configuration, but has the most recent history of C-class flaring. The remaining regions on the disc are small and stable.
Solar activity is expected to be Low or Very Low, with a very slight chance of M-class flares.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	5	5	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES-16 X-Ray Flux



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at background levels, and will most likely remain at this level through the period, in the absence of any significant sunspot development.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) is expected to initially continue at high levels, with a steady decline in the diurnal peak through the next four days. The diurnal peaks however are still likely to exceed the high (1e3pfu) threshold by the end of the period. The rate of decline is expected to be slow, with no high speed streams or strong CMEs expected and thus no significant geomagnetic activity. Any decline however is subject to the potential arrival of two forecast weak CMEs, one feature already potentially affecting the near-Earth environment and one forecast to arrive late on 04 July.

Electron fluence values are forecast to exhibit a declining trend through the next four days, as the electron flux values slowly decrease. In the absence of notable mechanisms for distortion or redistribution within the belts, the Active (1e8 integrated pfu) threshold is expected to be exceeded on 02 July, with a likelihood of this continuing through 03 and 04 July, before reducing by 05 July, with the potential arrival of a high speed stream from CH97.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	70	50	40	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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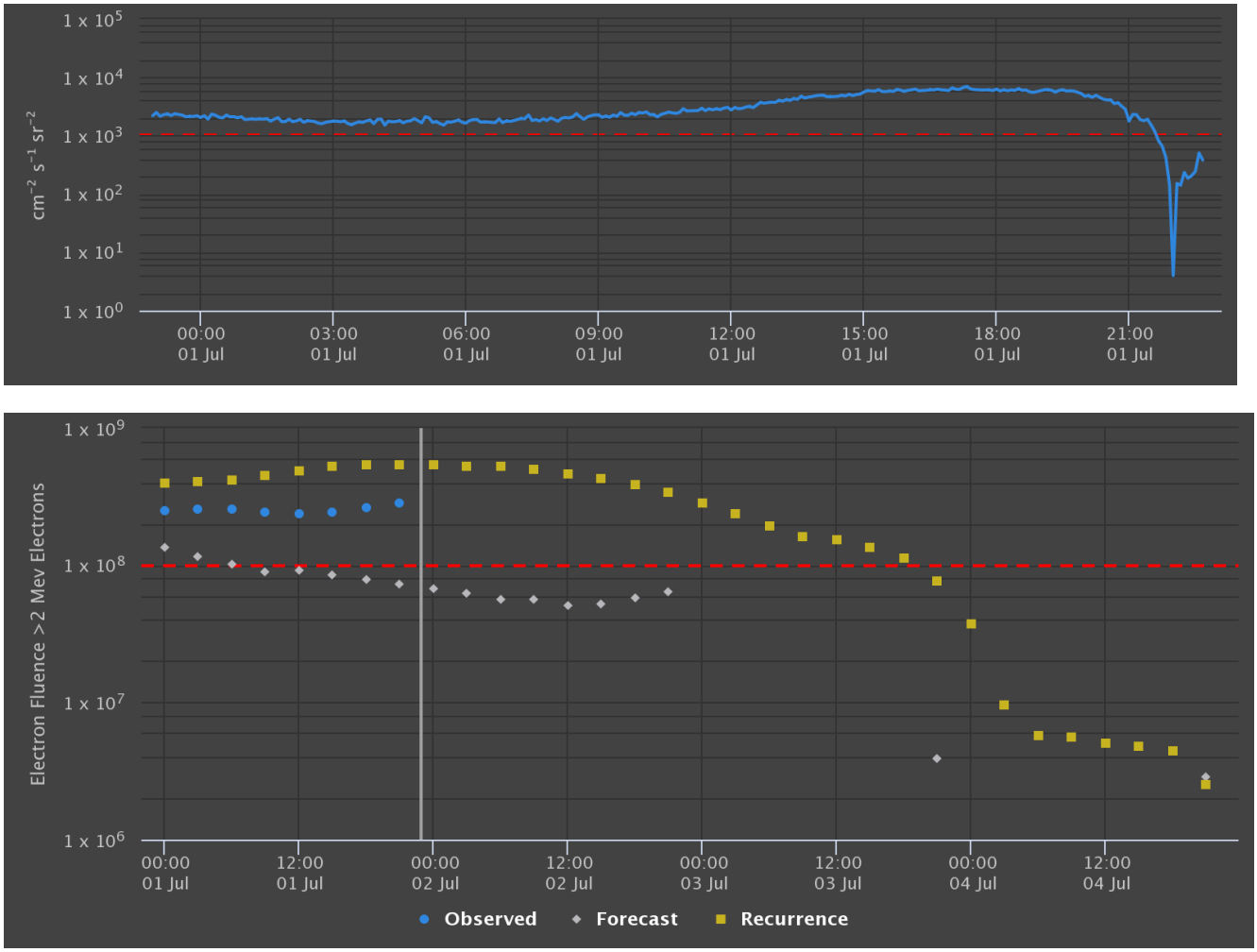
Figure 4: GOES-16 Electron Flux and MOSWOC REFM model.



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